

Voyager 2 Enters Interstellar Space

More than 18 billion kilometers from home, Voyager 2 has become the second probe to break through the heliopause, a tenuous boundary between the solar system and the rest of the Galaxy.

Our Sun's influence extends well beyond the planets. A steady breeze of charged particles known as the solar wind blows far past Neptune until it gives way to the interstellar plasma that fills the Galaxy. To some researchers, that boundary, known as the heliopause, marks the dividing line between the Sun's territory and interstellar space.

Voyager 2 passed the heliopause on November 5th, when a plasma detector onboard the spacecraft recorded a sharp decline in the speed of the solar wind. "We're not seeing the solar wind anymore," said John Richardson (MIT), principal investigator for Voyager's plasma experiment. "That means we must be in the interstellar medium."

Around the same time that the solar wind vanished, Voyager 2 also saw a sharp uptick in cosmic rays — high-speed atomic particles that whiz around the Galaxy — as well as an increase in the ambient magnetic field. This confluence of events gave mission scientists confidence that the probe had finally broken out of the heliosphere, a bubble of space surrounding the Sun in which the solar wind reigns supreme.

In 2012, Voyager 1 crossed the heliopause, though its plasma detector had stopped working back in 1980. With Voyager 2 now joining its twin in interstellar space, scientists will be able to obtain the first direct measurements of the ionized gas that drifts between the stars and will have a second set of eyes on the flux of cosmic rays impinging on the solar system — measurements that can only be obtained from outside the heliosphere.

"The heliosphere acts as a force field," Denolfo explained. It blocks many (though not all) of the galactic cosmic rays from reaching Earth. These zippy particles, hurtling through space at nearly the speed of light, are thought to blast out of supernovas, stellar explosions that have helped shape the region of space surrounding the solar system.

Voyagers 1 and 2 launched 16 days apart in 1977 and embarked on a grand tour of the outer solar system. Both probes briefly visited Jupiter and Saturn. Voyager 1 continued on toward interstellar space while Voyager 2 veered off to Uranus and Neptune, becoming the first and only spacecraft to fly by the two ice giants.

Now more than 18 billion kilometers (11 billion miles) from home, Voyager 2 puts roughly another 1.3 million kilometers (820,000 miles) between itself and Earth every day. At that distance, radio signals traveling at the speed of light require over 16 hours to get back to Earth. Voyager 1 is farther out still, nearly 22 billion kilometers (13 billion miles) away.

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“Both spacecraft are very healthy, if you consider them as senior citizens,” said Voyager project manager Suzanne Dodd (JPL). The biggest concerns right now are electrical power and heat, both of which are needed to keep the instruments working. In particular, the temperature on Voyager 2 is just shy of 4 degrees Celsius, she said, which is close to the freezing point of hydrazine needed to operate the thrusters.

In the coming years, scientists will have to decide which instruments to switch off and when. “We anticipate operating for another 5 to 10 years,” said Dodd. “My own personal goal would be to get these spacecraft to last 50 years.”